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A NEW SPECIES OF BURROWING ACONTIATE ANEMONE FROM CALIFORNIA (ISOPHELLIIDAE: FLOSMARIS)

By CADET HAND *and* RALPH BUSHNELL[1]

In a series of papers, Hand (1955, 1955a, 1956, 1958) described certain of the sea anemones of central California. The new species herein considered adds to that list.

The first specimens were collected in 1949 from intertidal mud flats of San Francisco Bay adjacent to Bay Farm Island, Alameda County, California. The flat is composed of fairly firm sand in which is mixed considerable mud and accumulated mollusk shells in various stages of disintegration.

The anemones occur with the base attached to fair sized remains of clam shell, small stones or even pieces of wood some 30–46 cm. beneath the surface. The oral end extends to the surface. Thus, when located in their original habitat, most of the 70 animals so far found, were about 30–46 cm. in length; however, they are only about 6–7 mm. in diameter except at the disc and base. The base may be up to 2.5 cm. in diameter and well covered with bits of clam shell and much sand, which remain adhering when the animal is dug from its burrow. Much care is needed in digging this species from its natural position as it is very easy to misjudge the depth at which the base is located,

[1] Both authors: Department of Zoology, University of California, Berkeley, Calif.

and, as frequently happens, the specimen may be cut in two before the base is freed from its attachment.

The area inhabited by this species is between the midintertidal and the mean lower-low water level, and they are most easily obtained by searching for them when there is a good minus tide. At these times they are commonly observed with their tentacles extended at the entrance to their burrow, but any movement near them will cause them to contract so that the body is drawn down into the burrow. As one starts to dig for them, they continue to contract until they reach one-third or less of their normal length. When the collector is successful in dislodging them he retrieves an anemone appearing to be about 10–15 cm. long and about 2 cm. in diameter at its widest part (exclusive of the foot). Occasionally, when too much pressure is applied against them in their burrows they will be seen to emit tiny jets of water from cinclis-like openings in the upper column. We do not believe that this is a natural reaction or one that would occur frequently in the absence of abnormal pressure. Weak areas evidently occur in the upper part of the column, but histologically these do not appear to be typical cinclides.

So far in the laboratory, we have not been able to relax specimens to anywhere near their normal length, i.e., 30–46 cm. On preservation they tend to shorten to 15 cm. or less.

We wish to thank both Mr. Marshall and Mr. Holleman for making the observations reported herein available to us.

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Family Isophelliidae

ISOPHELLIIDAE Stephenson, 1935, p. 183.

Thenaria (Acontiaria). Sphincter mesogloeal. Mesenteries divisible into macro- and microcnemes; the older microcnemes may, however, be provided with filaments and acontia. Acontia with two categories of nematocysts, basitrichs, and microbasic amastigophores.

Genus *Flosmaris*

Flosmaris Stephenson, 1920, p. 441.

Isophelliidae with the elongate column divisible into scapus and scapulus, the former with tenaculi. Cinclides present or possibly absent. Margin tenaculate. Tentacles simple, their longitudinal muscles ectodermal as are the radial muscles of oral disc. Sphincter mesogloeal; situated in upper part of scapulus. Twelve pairs of macrocnemes bearing gonads, though number may vary as result of

asexual reproduction. Macrocnemes all perfect and with strongly restricted to circumscribed retractors. Microcnemes weak, consisting chiefly of parietal muscle. Acontia present on macrocnemes and sometimes on some microcnemes. Cnidom: spirocysts, basitrichs, microbasic amastigophores; also atrichs and holotrichs if catch-tentacles are present.

The generic diagnosis above is the one given by Hand (1961). It differs slightly from that of Stephenson (1920) and incorporates certain modifications resulting from the inclusion of *Flosmaris bathamae* Hand (1961) in this genus.

Flosmaris grandis, new species

FIGURES 1, 2

Base: Generally circular, adherent and usually larger than scapus. Basilar muscles present and well developed.

Column: Elongate, divided into scapus and scapulus, cylindrical and up to 20 cm. long and 2 cm. diameter in the preserved condition. In living condition within their burrows, column is up to 46 cm. long. Diameter of column tapers from less than 0.5 cm. just above base to about 1.5 cm. in region of scapulus in a large individual. Removed from natural surroundings, column usually expanded in upper two-thirds, tapering to meet flaring base, and resembling long, slender goblet (fig. 1). Column translucent or pale white, depending on degree of expansion or contraction of individual. Mesenterial insertions visible as pale white lines.

Scapulus short, usually less than one-fifth of total column, somewhat more transparent than scapus and thereby distinguished from the latter. Histological preparations show a thinning of all layers in the scapulus. No cinclides or tenaculi present in scapulus and there appear to be fewer gland cells in scapus.

Scattered tenaculi present in upper third of scapus, but sand grains rarely found attached to them. Weakened areas somewhat comparable to poorly developed cinclides present in upper part of scapus. Mesogloea of column about of the same thickness as endoderm but only about 0.8 as thick as ectoderm.

Mesogloeal sphincter (fig. 2*a*) fairly well developed at top of the scapulus and immediately adjacent to tentacle bases.

Circular, endodermal muscles present throughout length of column but not extensively developed.

Tentacles and Oral Disc: All the specimens so far examined have only regular tentacles, catch tentacles being unobserved. From 90 to 144 tentacles have been counted on various individuals. Inner tentacles usually hexamerously arranged. Individual tentacles extend to 1.6 cm. in length, and total crown may attain a diameter of as much as 3.5 cm. Tentacles thin, transparent, and gently tapered.

Only a small amount of coloration is found on animal and is in bars or incomplete rings of white granules against a dark background at bases of tentacles. Lips seldom seen raised above level of disc and are smooth and unpigmented.

Tentacles fully retractile and have ectodermal longitudinal muscles. Radial musculature of disc is ectodermal also.

Mesenteries: In upper part of body of perfect specimens there are 12 pairs of complete and fertile macrocnemes, including 2 pairs of directives that correspond to the 2 siphonoglyphs, and 36 pairs of

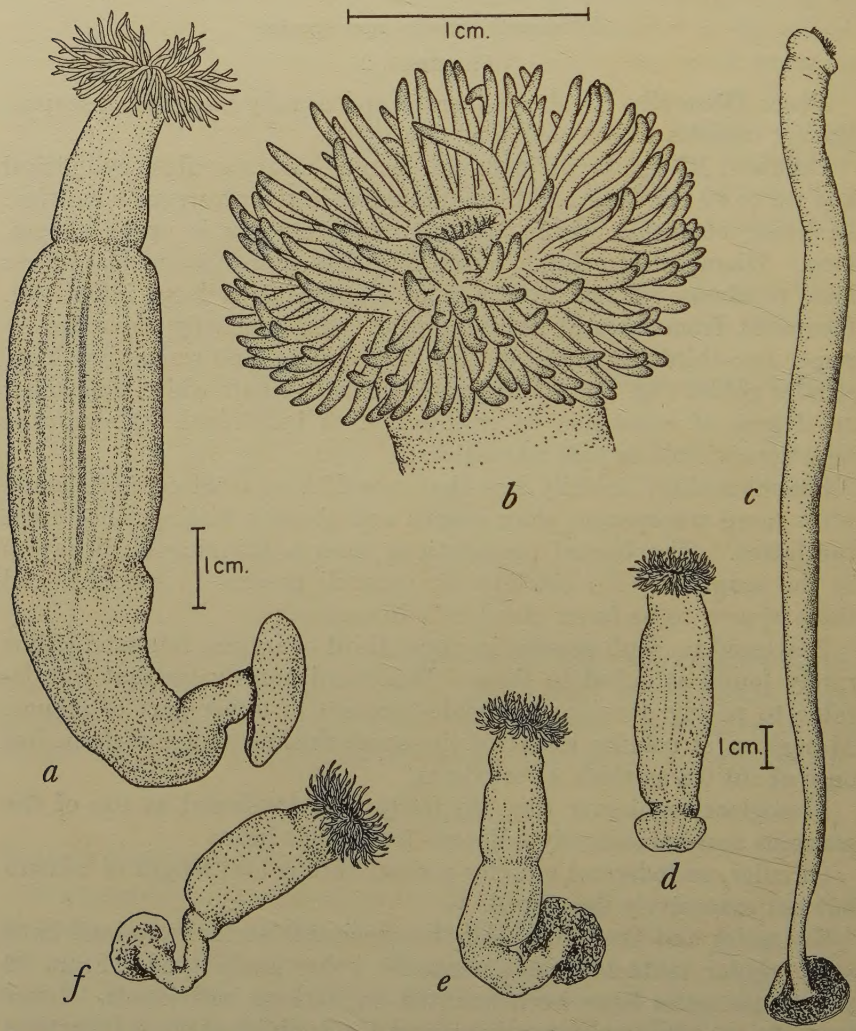

FIGURE 1.—*Flosmaris grandis: a, d–f,* live specimens removed from their burrows; *b,* enlargement of the oral disc and tentacles; *c,* relaxed and extended preserved specimen.

microcnemes (fig. 2*b*). In scapus, especially lower parts, number of microcnemes decreases, and there are approximately half as many mesenteries at base as in oral end (fig. 2*c*). Dissections of 12 specimens and sections of 6 showed from 8 to 12 pairs of mesenteries may be perfect, fertile macrocnemes (fig. 2*d*). No form of asexual reproduction has been observed in this species.

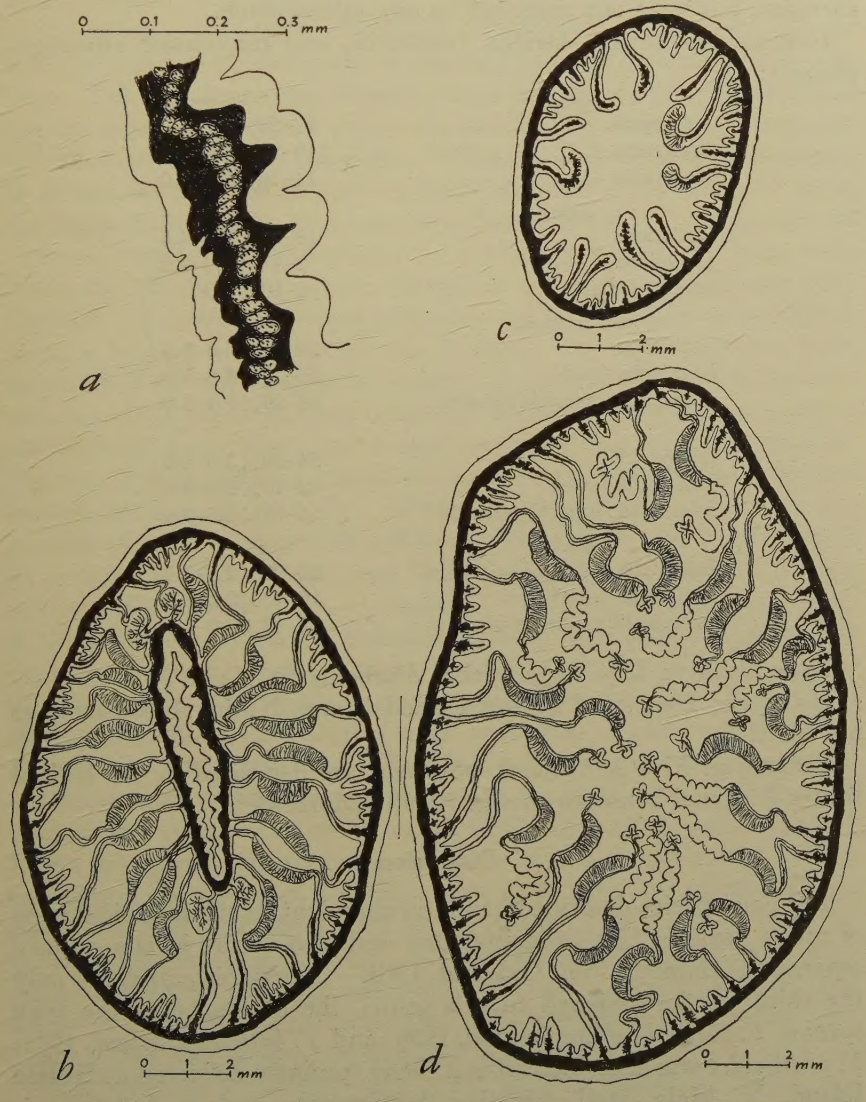

FIGURE 2.—*Flosmaris grandis: a*, sphincter muscles within the mesogloea; *b*, cross section of mesenteries in region of actinopharynx; *c*, cross section of column just above pedal disc; *d*, mesenteries in midregion of the column.

The 6 pairs of macrocnemes of first cycle have large restricted retractors (fig. 2*b*) running throughout their length, while second cycle has only slightly smaller restricted retractors. Directive retractors tend to be circumscript. There is a moderately well-developed parietal musculature on macrocnemes, while microcnemes (fig. 2*b*) consist only of parietal muscles, there being no mesenterial sheet. A trifid mesenterial filament and acontium are present on each macrocneme, but were not observed on any microcneme.

Cnidom (spirocysts, atrichs, basitrichs, and microbasic amastigophores):

tentacles	*microns*
spirocysts	17–22×3.0–4.0
basitrichs	19–27×3.0–4.0
basitrichs	14–16×2.5–3.0
scapus	
basitrichs	18–26×3.0–3.5
basitrichs	9–14×2.0–2.5
atrichs (rare)	8–10×3.0
actinopharynx	
basitrichs	26–34×5.0–6.0
basitrichs (rare)	18–20×4.0–5.0
microbasic amastigophores	16–20×5.0–6.0
filaments	
basitrichs	24–29×3.0–4.0
basitrichs (rare)	12–16×2.0–3.0
microbasic amastigophores	14–18×4.5–6.0
acontia	
basitrichs	20–29×2.5–3.0
basitrichs (rare)	16–18×2.0–2.5
microbasic amastigophores	33–42×5.0–7.0

Type locality: Bay Farm Island, Alameda Co., Calif.

Holotype: Deposited in the United States National Museum as no. 52592.

Paratypes: Five additional specimens are deposited in the United States National Museum as nos. 52593 and 52594.

Discussion

The new species described herein is abundant in the intertidal zone of many parts of San Francisco Bay and also occurs in the estuary separating Alameda from Oakland, Calif. *Flosmaris grandis* is only the third species assigned to this genus, the others being the type species, *F. phellioides* Stephenson, 1920, and *F. bathamae* Hand, 1961. *F. phellioides* was described from a single specimen collected at Hulule Island, N. Male Atoll, Maldive Archipelago, and *F. bathamae* is known only from Otago Harbor in southern New Zealand. *F. bathamae* is a small species, the maximum length being about 2.5 cm.,

while *F. grandis* is some 18 times longer than this. The size of *F. phellioides* is not known. There is some question, certainly, whether *F. bathamae* and *F. grandis* are cogeneric with *F. phellioides*. Stephenson's original description of *F. phellioides* is very brief and no diagnosis of nematocysts was given. The new species agrees with the type species in having more mesenteries distally than proximally, but differs from *F. bathamae* in this respect. Also, no catch tentacles have been observed in *F. grandis* or *F. phellioides*, but they are present in *F. bathamae*. *F. grandis* resembles *F. bathamae* in its restricted retractors whereas *F. phellioides* is reported to have circumscript retractors. For the time being it seems most reasonable to treat all these species as members of the genus *Flosmaris*, and what is most needed is fresh material of *F. phellioides*. When *F. phellioides* is rediscovered it should be possible to make a more detailed comparison of these species and, hopefully, to understand better the nature of this genus.

Some interesting observations on *F. grandis* in captivity have been made by Mr. Edward Arthur Marshall, a student at Oakland City College. We received these observations through Mr. John Holleman, a biology instructor at the College. Mr. Marshall has kept individuals of this species in unaerated aquaria for several months and has observed that when detached from the substrate and placed on sand in water that the animals actively burrow and reattach. Burrowing is apparently accomplished by extensions of the pedal disc and undulations of the body. After attaching at a given point on the bottom of an aquarium with a 6.5 cm. deep layer of sand, movement from place to place occurs, and individuals were recorded as having moved a distance of 13 cm. overnight. The captive animals accepted a wide variety of foods including almost any small, soft-bodied organism. They readily accept small flies, the larvae of several insects, gnats, small spiders, small gastropods, and land slugs, brine shrimps, copepods, and small marine organisms in general, but refuse earwigs and small beetles. When food objects are dropped near an anemone, they extend the upper part of the body from their burrow toward the food. Successful capture of the food usually follows. When an injured, but living, house fly is placed on the surface of the aquarium, the anemone actively extends toward the surface of the aquarium, and captures it with its tentacles. This occurs only when the fly is still active and moving but trapped in the surface film. One might wonder if this last described behavior occurs in nature, and while no absolute answer is possible, it is readily demonstrable that many, many insects are indeed blown into the Bay.

The behavior described may then be one which is adaptively valuable to the species and a perfectly normal bit of behavior as well.

Summary

A new species of *Flosmaris*, *F. grandis* is described. This is the third species known in this genus. The genus is not well understood, and the type species, *F. phellioides* from the Maldive Islands needs to be restudied. Some observations on the living animals are reported, and the capture of food on the surface of an aquarium is described.

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